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6. AUTHOR(S)
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13. ABSTRACT *(Maximum 200 words)*

The Woods Hole Workshop on Computational Neuroscience at the Marine Biological Laboratory was held for one week each August in 1992 to 1994. Each year, twenty investigators who are concerned with the computational functions of nervous systems had intense discussion on a wide range of topics in computational neuroscience, including neural mechanisms for computation, neural systems for long-term memory, neural decisions, and active perception. In addition, some members of the workshop lectured in the concurrent Computational Neuroscience Course at MBL, and students were invited to attend the workshop.

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Terrence Sejnowski

FINAL REPORT

ONR Grant N00014-92-J-1442

Workshop in Computational Neuroscience

1992-1994

Summary

The Woods Hole Workshop on Computational Neuroscience at the Marine Biological Laboratory was held for one week each August in 1992 to 1994. Each year, twenty investigators who are concerned with the computational functions of nervous systems had intense discussion on a wide range of topics in computational neurosciewnce, including neural mechanisms for computation, neural systems for long-term memory, neural decisions, and active perception. In addition, some members of the workshop lectured in the concurrent Computational Neuroscience Course at MBL, and students were invited to attend the workshop.

Organization of the Workshop:

The Woods Hole Workshop on Computational Neuroscience at the Marine Biological Laboratory (MBL) was first held in 1984. Organized by Terrence Sejnowski, it brought together, for the first time, leading researchers from neuroscience and computer science who were concerned with understanding the computational resources of nervous systems. Since 1987, the workshop has been held in conjunction with the Summer Course on Computational Neuroscience at the Marine Biological Laboratory. The week-long workshop has been held during the last week of the month-long summer course, and members of the workshop serve as faculty for the students..

Each participant was allowed 90 minutes to present a new finding, including discussion. Two general sessions were held each day, one the morning from 9 AM to 12 Noon, and the second in the evening from 7 PM to 10 PM. Each sessions included two presentations, one from an experimentalist, and one from a theoretician. The afternoons were free to allow the participants to form small groups for lunch and other activities. These activities included interactions with the students in the summer course; a picnic organized by Robert Bosler, a resident of Woods Hole, and a student-faculty volleyball game. The special environment in Woods Hole, which is a major summer research center in neurobiology and has

great physical beauty, has given the workshops a perfect setting and created an ideal place for cross disciplinary interactions to occur.

The central themes of the three workshops that were held at the Marine Biological Laboratory from 1992 to 1994 were neural coding and dynamical information processing in large populations of neurons. A majority of the participants in these workshops were experts on visual processing, but selected sessions on auditory and olfactory coding were also highlighted. In the three years summarized here, a total of 60 researchers participated in the workshops (see appendix).

Neural mechanisms for computation. Each workshop included several talks that were concerned with the biophysical mechanisms that are responsible for information processing in neurons. For example, in 1994, two sessions were devoted to the information carried by single spikes (Sejnowski: spike initiation; Koch: spike timing in area MT; Bialek: adaptive temporal filtering in the fly motion processing system). The issue of temporal processing of information was also address in talk be Laurent, on the olfactory coding in the locust, and by Seung on the neural integrator in the oculomotor system.

Neural systems for long-term memory An important issue that arose in the 1994 workshop was the coding of space in the hippocampus (Wilson) and the learning mechanisms that might be responsible for forming new spatial representations (Abbott and Lisman). In addition, a modeling talk that explored the dynamics of attractor networks was presented that might account for new observations regarding the tendency for hippocampal neurons to form spatial clusters (Tsodyks). Tishby also presented an analysis of data from the visual cortex that indicated a similar tendency of cortical neurons to form temporal clusters during a delayed match-to-sample task.

Neural decisions. Over the last several years, recordings of single neurons from area MT have revealed that single neurons are capable of encoding sensory information with the same accuracy as the response of the monkey. In the best-studied perceptual task, the monkey is asked to decide on the direction of motion in a display of correlated randomly moving dots.. Shadlen showed, in recordings from the parietal region of the monkey cortex, that some neurons reliably encode the decision of the monkey. Maunsell and evidence Desimone also found evidence for decision-related signals in other parts of the monkey's cortex during tasks that require short-term memory.

Active Perception. Animals are not passive observers, but actively interact with their environment. This is most clearly seen in observer self-motion (Royden) where visual cues in the motion flow field are used

to judge heading. Ballard has pioneered the theoretical study of active perception. At the workshop, he showed that humans favor strategies that rely on eye-movements rather than memory when given free choice in solving a copying task. This suggests that rather than create a detailed internal model of the outside visual world, the visual system instead creates simpler representations that fulfill immediate needs of the motor system when solving a task. Ballard also demonstrated the possibility of studying the performance of humans in complex tasks such driving suing recent advances in virtual reality.

Facilities at MBL

The Workshop was held at MBL because it has the highest concentration of neurobiologists during the summer of any institution in the world, and MBL offers the most advanced training in other aspects of neurobiology during the summer (Courses in Neurobiology, Neural Systems and Behavior, Cellular Neurobiology of the Leech, and Methods in Computational Neuroscience. The overall site is superb from the point of view of facilities (a 24 hour world-class library), location (90 minute drive from Boston), and amenities (restaurants, recreational facilities, computer access all within walking distance).

10th Annual Woods Hole Workshop on Computational Neuroscience

Marine Biological Laboratory
August 22 - August 28, 1994

Monday, August 22

Hippocampal Dynamics

7:00 p.m.	Matthew Wilson, University of Arizona
8:30 p.m.	Break
9:00 p.m.	Laurence Abbott, Brandeis University
10:30 p.m.	Beer and wine

Tuesday, August 23

Cortical Dynamics

9:00 a.m.	Mishail Tsodyks, Salk Institute
10:30 a.m.	Break
11:00 a.m.	Rodney Douglas, Oxford
12:30 p.m.	Lunch

Neural Assemblies

7:00 p.m.	Gilles Laurent, Caltech
8:30 p.m.	Break
9:00 p.m.	Naftali Tishby, Hebrew University
10:30 p.m.	Beer and wine

Wednesday, August 24

Visual Attending

9:00 a.m.	Alexander Pentland, MIT Media Lasboratory
10:30 a.m.	Break
11:00 a.m.	Robert Desimone, NIMH
12:30 p.m.	Lunch

Cortical Mechanisms

7:00 p.m.	David Kleinfeld, AT&T Bell Laboratories
8:30 p.m.	Break
9:00 p.m.	David Tank, AT&T Bell Laboratories
10:30 p.m.	Beer and wine

Thursday, August 25

Cortical Processing

9:00 a.m.	Steven Zucker, McGill University
10:30 a.m.	Break
11:00 a.m.	Allan Dobbins, Caltech
12:30 p.m.	Lunch

Active Vision

7:00 p.m.	Constance Royden, Wellesley College
8:30 p.m.	Break
9:00 p.m.	Dana Ballard, Rochester University
10:30 p.m.	Beer and Wine

Friday, August 26

Visual Decisions

9:00 a.m.	John Maunsell, Baylor College of Medicine
10:30 a.m.	Break
11:00 a.m.	Michael Shadlen, Stanford University
12:30 p.m.	Lunch

Neuronal Reliability

7:00 p.m.	Christof Koch, Caltech
8:30 p.m.	Break
9:00 p.m.	Terrence Sejnowski, Salk Institute
10:30 p.m.	Beer and wine

Saturday, August 27

Sensory Statistics

9:00 a.m.	Fabrizio Gabbiani, Caltech
10:30 a.m.	Break
11:00 a.m.	William Bialek, NEC Research
12:30 p.m.	Lunch

3:00 p.m.	Student Demonstrations
6:00 p.m.	Lobster Banquet

Woods Hole Workshop on Computational Neuroscience - 1994 Marine Biological Laboratory

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August 8, 1995

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Subj: Final Report

Ref: ONR Grant N00014-92-J-1442

Gentlemen:

On behalf of the Marine Biological Laboratory and the Principal Investigator of the above-referenced grant, Dr. Terrence Sejnowski, I enclose three copies of the final report for the "Workshop in Computational Neuroscience".

Please contact this office if you have any questions or require additional information.

Sincerely,

Sharon L. Hunt

Sharon L. Hunt
Grants Assistant

Enclosures

Copy to: ONR Grant Administrator (1 copy)
DTIC (1 copy)

Woods Hole Workshop on Computational Neuroscience - 1994 Marine Biological Laboratory

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9th Annual Woods Hole Workshop on Computational Neuroscience

Marine Biological Laboratory
August 21 - August 27, 1993

Saturday, August 21

Reception

7:00 p.m.	Beer and wine

Sunday, August 22

Sensory Coding

9:00 a.m.	Linda Buck, Harvard School of Medicine
10:30 a.m.	Break
11:00 a.m.	William Bialek, NEC
12:30 p.m.	Lunch

Neural Assemblies

7:00 p.m.	Matthew Wilson, University of Arizona
8:30 p.m.	Break
9:00 p.m.	John Allman, Caltech
10:30 p.m.	Beer and wine

Monday, August 23

Visual Representations

9:00 a.m.	Michael Stryker, UC San Francisco
10:30 a.m.	Break
11:00 a.m.	Steven Zucker, McGill University
12:30 p.m.	Lunch

Memory Representations

7:00 p.m.	Robert Desimone, NIHM
8:30 p.m.	Break
9:00 p.m.	Dana Ballard, Rochester University
10:30 p.m.	Beer and wine

Tuesday, August 24

Cortical Microcircuits

9:00 a.m.	Rodney Douglas, Oxford University
10:30 a.m.	Break
11:00 a.m.	Douglas Miller, McGill University
12:30 p.m.	Lunch

Dendritic Processing

7:00 p.m.	David Tank, AT&T Bell Laboratories
8:30 p.m.	Break
9:00 p.m.	Christof Koch, Caltech
10:30 p.m.	Beer and Wine

Wednesday, August 25

Motion Processing

9:00 a.m.	Udi Zohary, Stanford Medical School
10:30 a.m.	Break
11:00 a.m.	Robert de Ruyter, NEC
12:30 p.m.	Lunch

Cortical Coding

7:00 p.m.	Pieter Roelfsema, Max-Planck, Frankfurt
8:30 p.m.	Break
9:00 p.m.	David Kleinfeld, AT&T Bell Laboratories
10:30 p.m.	Beer and wine

Thursday, August 26

Spatial Representations

9:00 a.m.	Apostolos Georgopoulos, University of Minnesota
10:30 a.m.	Break
11:00 a.m.	Richard Andersen, MIT/Caltech
12:30 p.m.	Lunch

Task-Dependent Processing

2:00 p.m.	John Maunsell, Baylor School of Medicine
3:30 p.m.	Break
4:00 p.m.	Terrence Sejnowski, Salk Institute/Caltech
5:30 p.m.	Dinner

Woods Hole Workshop on Computational Neuroscience - 1993 Marine Biological Laboratory

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8th Annual Woods Hole Workshop on Computational Neuroscience

Marine Biological Laboratory
August 22 - August 28, 1992

Saturday, August 22

8:30 p.m.	Reception, Loeb 201

Sunday, August 23

Dynamic and Modular Vision

9:00 a.m.	Dan Ts'o, Rockefeller University
10:30 a.m.	Break
11:00 a.m.	Alexander Pentland, MIT Media Lab
12:30 p.m.	Lunch

Olfactory Coding

7:00 p.m.	John Kauer, Tufts University Medical School
8:30 p.m.	Break
9:00 p.m.	James Bower, Caltech
10:30 p.m.	Beer and wine

Monday, August 24

Olfactory Associations

9:00 a.m.	Lewis Haberly, University of Wisconsin
10:30 a.m.	Break
11:00 a.m.	Michael Hasselmo, Harvard
12:30 p.m.	Lunch

Beyond Single Units

7:00 p.m.	John Allman, Caltech
8:30 p.m.	Break
9:00 p.m.	David Tank, AT&T Bell Laboratories
10:30 p.m.	Beer and wine

Tuesday, August 25

Eye Movements

9:00 a.m.	Carol Colby, NIMH
10:30 a.m.	Break
11:00 a.m.	Dana Ballard, University of Rochester
12:30 p.m.	Lunch

Space and Time

7:00 p.m.	Richard Andersen, MIT
8:30 p.m.	Break
9:00 p.m.	David Kleinfeld, AT&T Bell Laboratories
10:30 p.m.	Beer and Wine

Wednesday, August 26

Cortical Circuitry

9:00 a.m.	Rodney Douglas, MRC Neuroanatomical Unit, Oxford
10:30 a.m.	Break
11:00 a.m.	A. B. Bonds, Vanderbilt University
12:30 p.m.	Lunch

Cortical Development

7:00 p.m.	Michael Stryker, UC San Francisco
8:30 p.m.	Break
9:00 p.m.	Terrence Sejnowski, Salk Institute/UC San Diego
10:30 p.m.	Beer and wine

Thursday, August 27

Cortical Architecture

9:00 a.m.	Gary Blasdel, Harvard
10:30 a.m.	Break
11:00 a.m.	Steven Zucker, McGill University
12:30 p.m.	Lunch

Cortical Coding

7:00 p.m.	Michael Shadlin, Stanford Medical School
8:30 p.m.	Break
9:00 p.m.	Christof Koch, Caltech
10:30 p.m.	Beer and wine

Woods Hole Workshop on Computational Neuroscience - 1992 Marine Biological Laboratory

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